Task Allocation Using Continuous Resource Distributed Markov Decision Processes

Completed Technology Project (2011 - 2015)

Project Introduction

Exploration of other planets will require teams of robotic rovers to first precede and later assist human explorers. A critical challenge will then be to generate plans for these rovers so as to maximize their productivity while minimizing the time and energy spent to complete a set of tasks. The tasks assigned to an agent may feature temporal constraints as well as complex interdependencies with other tasks, including those assigned to another agent. Numerous techniques have been developed to efficiently compute policies for a single agent using continuous resource Markov Decision Processes (CR-MDP). However, expanding such algorithms to situations involving multiple agents is difficult, given that the complexity of solving decentralized Markov Decision Processes (DEC-MDPs) has been shown to be NEXP-complete. Even when using approximate algorithms, it is difficult to achieve the scale-up necessary to model the size and complexity of real-world domains using distributed CR-MDPs (CR-DEC-MDP). I intend to explore methods for solving CR-DEC-MDPs more efficiently, including (1) fast, locally optimal methods that exploit domain structure; and (2) efficient methods of convolution using fast Fourier transform (FFT).

Anticipated Benefits

Exploration of other planets will require teams of robotic rovers to first precede and later assist human explorers. This project aims to address the critical challenge of generating plans for these rovers so as to maximize their productivity while minimizing the time and energy spent to complete a set of tasks.

Primary U.S. Work Locations and Key Partners
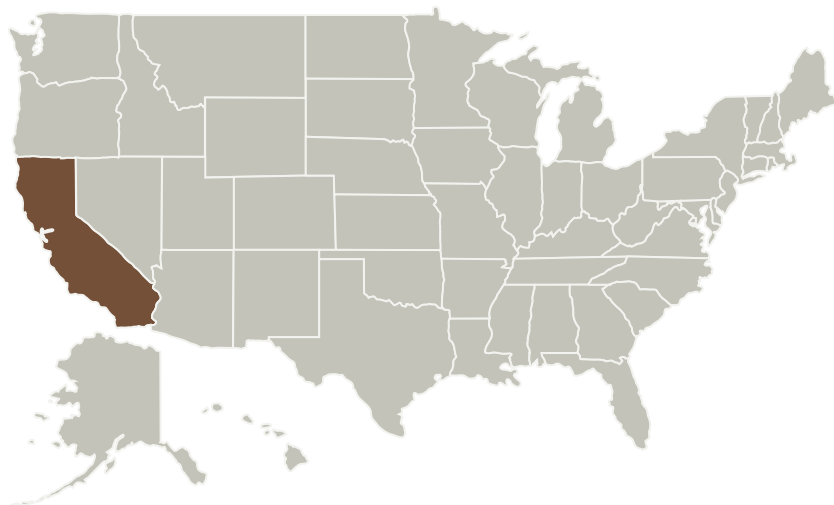
Project Image Task Allocation Using Continuous Resource Distributed Markov Decision Processes

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Responsible Program:

Space Technology Research Grants

Primary U.S. Work Locations
California

Images

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Project Image Task Allocation Using Continuous Resource Distributed Markov Decision Processes
(https://techport.nasa.gov/image/1833)

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Project Management

Program Director:
Claudia M Meyer

Program Manager:
Hung D Nguyen

Principal Investigator:
Milind Tambe

Co-Investigator:
Matthew R Brown

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**

1	2	3	4	5	6	7	8	9
	Applied Research			Development			Demo & Test	
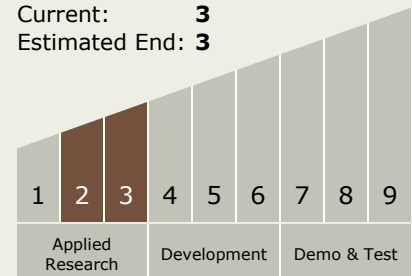
Technology Areas

Primary:

- TX10 Autonomous Systems
  └ TX10.2 Reasoning and Acting
    └ TX10.2.2 Activity and Resource Planning and Scheduling

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For more information and an accessible alternative, please visit:
https://techport.nasa.gov/view/4311

Page 2